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Improving Physical Models of Qubit Decoherence and Readout

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Qubit coherence measurements are now sufficiently accurate that they can be used to perform 'spectroscopy' of noise due to a complex environment. Measuring not only the decay time, but also the form of decay as a function of some external parameter (e.g. temperature) can determine the nature of the dominant decoherence source. I will describe how temperature-dependent measurements of qubit decoherence time and form of decay can distinguish between a number of different possible sources of environmental charge flucutations (including tunneling and cotunneling with a continuum band, as well as one- and two-phonon absorption processes). These results can be used to identify and suppress dominant charge-noise dephasing mechanisms in semiconductor nanostructures.

I will also briefly discuss some new tricks to enhance the fidelity of generic qubit readouts by understanding the physical dynamics of these systems.

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